

A NEW ARBOREAL *CARABODES* FROM EASTERN NORTH AMERICA  
(ACARI: ORIBATIDA: CARABODIDAE)

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Abstract.—*Carabodes dendroetus* n. sp. is described. It is the first North American member of the genus found primarily in arboreal habitats that shows a preference for the bark and branches of conifers or hardwoods rather than rotten logs and leaf litter on the forest floor. It is distributed from Nova Scotia and New Brunswick south through New England and Pennsylvania to western North Carolina.

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Oribatid mites reach their highest diversity and abundance in forest litter and soil where densities have been estimated at 55,000–425,000/m<sup>-2</sup> (Wallwork, 1983). The epigeal oribatid fauna, while not as diverse and abundant, was considered by Wallwork to offer considerably more promise in ecological studies because of the more isolated and simplified microhabitats available for study. Trave (1963) compared the edaphic with the epigeal fauna and found three of six species of *Carabodes* were present in nearly equal numbers in these two habitats. The thick, hard exoskeleton of *Carabodes* was suggested as the most important factor in their survival in epigeal zones. Luxton (1972) considered *Carabodes* to be panphytophages and thus better able to exploit a variety of habitats because of their wide food preferences.

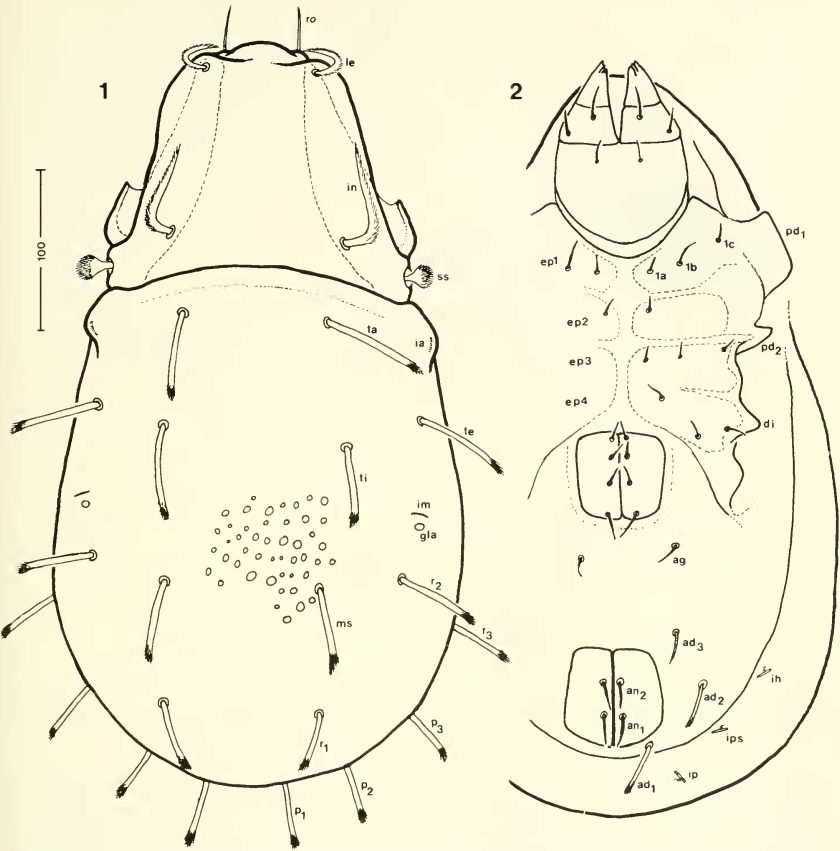
During an examination of organisms extracted from fir and spruce branches using the hot lye process of Miller and McDougall (1968) for removal of spruce budworm larvae, I found the following seven species of *Carabodes*: *granulatus* Banks, *labrynthicus* (Michael), *niger* Banks, *willmanni* Bernini and three undescribed species. One of these undescribed species I had previously col-

lected in large numbers from sugar maple, oak and white pine bark but rarely from forest litter, and then usually as single specimens. Thus, I believe this new species to be primarily arboreal, hence the name "dendroetus" from the Greek meaning tree dweller.

Terminology and abbreviations are those developed by F. Grandjean, as summarized by Balogh and Mahunka (1983). All measurements are in micromillimeters and made from unmounted specimens. Line drawings were made from dissected specimens and may be a composite of more than a single specimen. Collection/extraction methods varied from using Berlese funnels to extract mites from litter or from sifted litter, extraction from branches using a hot lye solution and collecting mites directly from bark and foliage using a microscope. Names of the following collectors are abbreviated: D.S.C.—D. S. Chandler, A.G.—A. Godfrey, R.H.H.—R. H. Hutchins, and R.M.R.—R. M. Reeves.

*Carabodes dendroetus* Reeves,  
NEW SPECIES

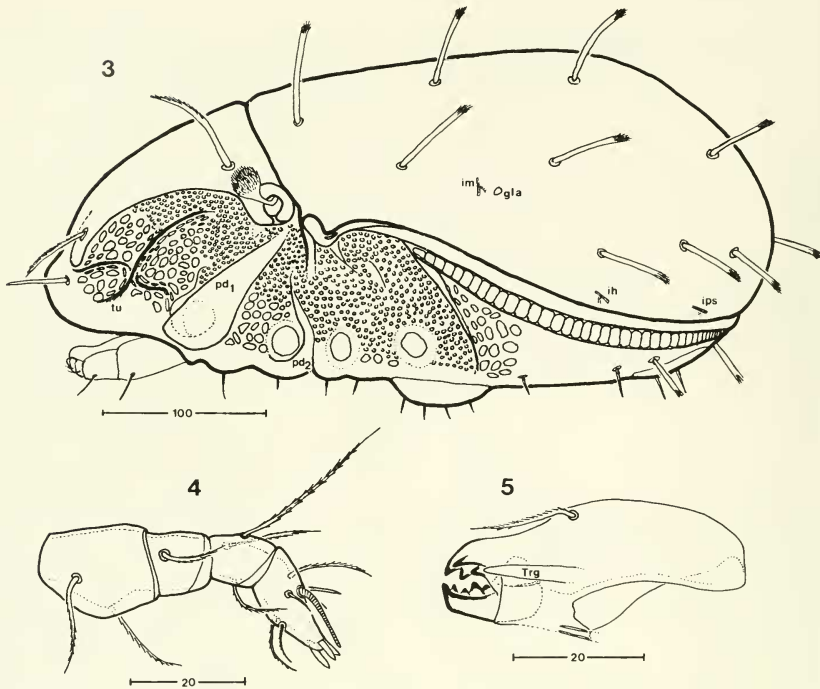
Adult.—*Measurements*: Mean length (measured from tip of rostrum to posterior



Figs. 1, 2. *Carabodes dendroctetus*, adult. 1, Dorsal view. 2, Ventral view.

edge of notogaster): female ( $n = 23$ ) 475 (range 439–513); males ( $n = 26$ ) 419 (range 390–454). Mean notogastral width (measured at widest point): females ( $n = 22$ ), 262 (range 245–291); males ( $n = 26$ ), 227 (range 194–252). Mean height (measured from genital-anal area dorsally to highest point of notogaster): females ( $n = 21$ ) 216 (range 184–247); males ( $n = 24$ ) 188 (range 168–209). *Integument*: Brown. Body and antiaxial surfaces of femora I–IV and trochanters III and IV covered with pits. *Prodorsum*:

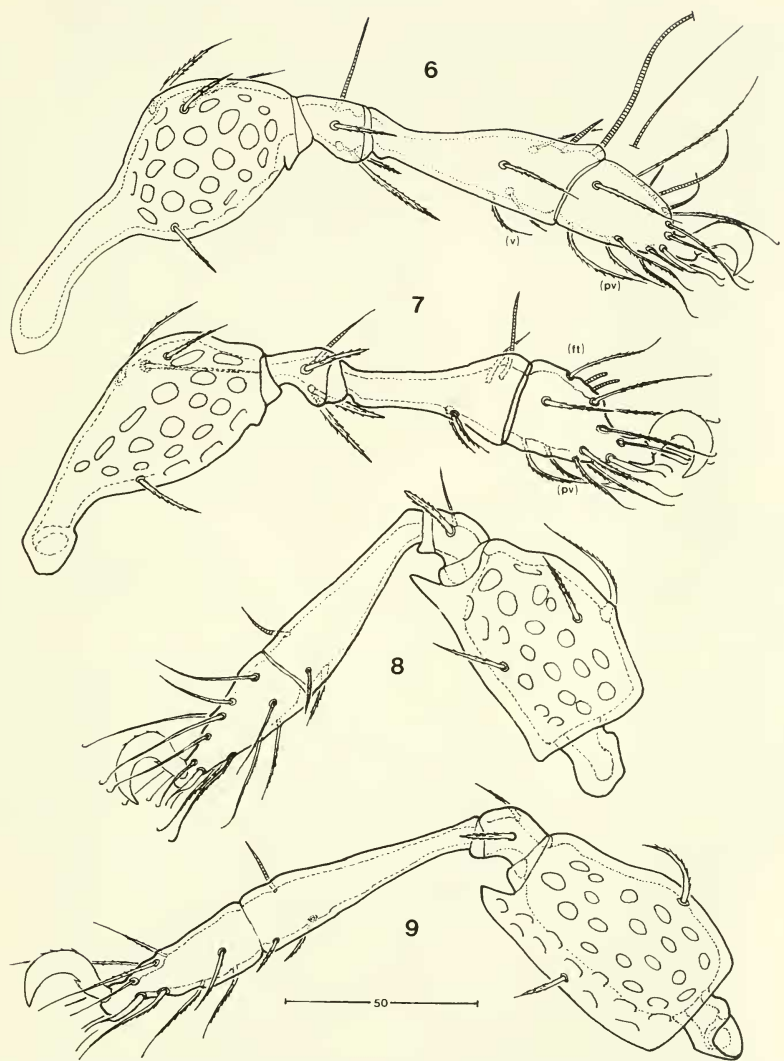
Prodorsal length: females ( $n = 23$ ) 141 (range 124–161); males ( $n = 26$ ) 132 (range 112–146). Prodorsum nearly completely covered with pits, pits most uniform in size and shape between rostral and lamellar setae (Fig. 15). Lamellae with very weakly developed pits medially, lateral margin smooth. Dorsal se-jugal groove narrow, pits becoming very irregular near groove (Fig 13). Rostral setae ( $ro$ ) very minutely barbed, slightly arched mesad, 9–12 long. Lamellar setae ( $le$ ) longer (12–16), more strongly barbed and arched



Figs. 3-5. *Carabodes dendroetus*, adult. 3, Lateral view with legs removed, integumental pits not shown on *pd*<sub>1</sub> and *pd*<sub>2</sub>. 4, Palpus, antiaxial view, trochanter removed. 5, Chelicera, paraxial view.

mesad than *ro*, inserted near anterior margin of lamellae (Figs. 1, 3, 15). Interlamellar setae (*in*) similar in shape to *le* but longer (20-25), inserted on prodorsal surface above internal medial edge of lamellae. Ventral wall of bothridium with a notch (Fig. 16). Sensillus (*ss*) short, capitate, head spinose on distal two thirds (Fig. 16). *Notogaster*: Notogaster with moderately sized, round pits (2-8 diameter) separated from adjacent pits by at least (usually more than) the pit diameter (Fig. 14). Laterally and posteriorly notogastral pits become less uniform in shape, often coalescing (Figs. 11, 12, 19). All notogastral setae similar: long, thin, nearly uniform in diameter throughout, barbed and slightly enlarged distally (minute barbs below tip visible only at high

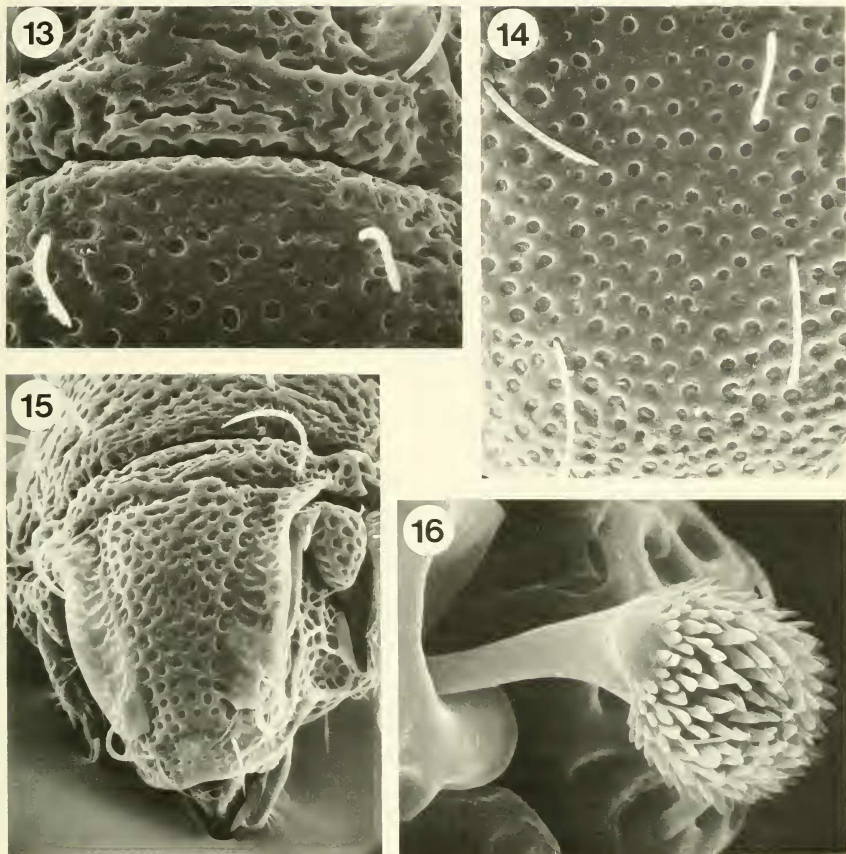
magnification and in SEM Fig. 10). Setal lengths diminish posteriorly with setae *p*<sub>1</sub>-*p*<sub>3</sub> approximately three fourths length of *ta*. Setal lengths (*n* = 4) of *ta*: 24-28, *te* 18-25, *ti*: 20-24, *ms*: 18-24, *r*<sub>1</sub>: 20-24, *r*<sub>2</sub>: 18-22, *r*<sub>3</sub>: 18-20, *p*<sub>1</sub>: 16-20, *p*<sub>2</sub>: 16-20, *p*<sub>3</sub>: 16-20. Length of *ta* and *ti* one half to two thirds distance between insertions of *ta-ti* and *ti-ms* setae respectively. Seta *ta* positioned anteromedial of *ti* so that *ta*, *ti*, *ms*, and *r*<sub>1</sub> form a nearly straight longitudinal row, with *te* and *r*<sub>2</sub> forming a parallel row (Figs. 1, 11). *Gnathosoma*: Diarthric. Mentum with pits. Setal positions as in Figs. 2, 17. Palpal formula: 0-2-1-3-9 (+1 solenidion) (Fig. 4). Chelicera chelate (Fig. 5). Tragardh's organ (*Trg*) present. *Ventral surface*: Pits on ventral surface similar to those on prodorsum



Figs. 6-9. *Carabodes dendroctus*, adult. 6, Leg I. 7, Leg II. 8, Leg III. 9, Leg IV. Anti-axial views, trochanters removed.



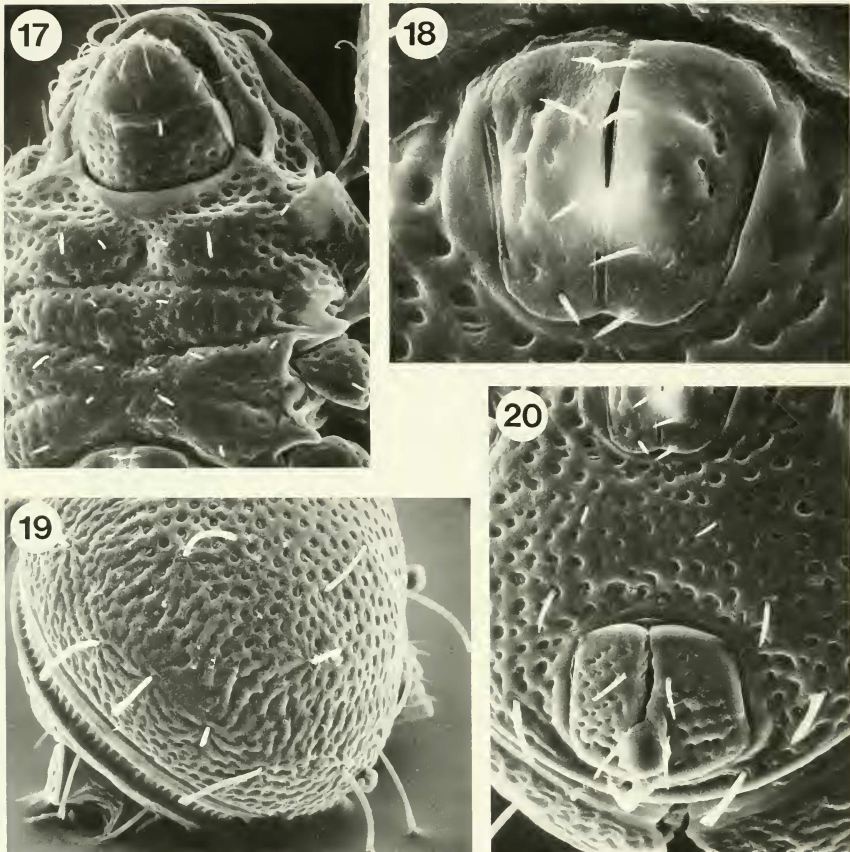
Figs. 10–12. *Carabodes dendroetus*, adult. 10, Seta  $r_2$  (2000 $\times$ ). 11, Dorsal aspect (220 $\times$ ). 12, Lateral aspect (240 $\times$ ).



Figs. 13-16. *Carabodes dendroetus*, adult. 13, Dorsal sejugal groove detail (830 $\times$ ). 14, Pits on notogaster between setae *ti* and *ms* (625 $\times$ ). 15, Prodorsum, anterior view (490 $\times$ ). 16, Sensillus (3530 $\times$ ).

and notogaster; least modified in shape near center of plates (Figs. 17, 20). Epimeral plates (*ep1-ep4*, Fig. 2) divided by distinct epimeral furrows (Fig. 17). Epimeral setal formula 3-1-3-3; seta *1b* longest (8-9), others 3-6 long. Four pairs of genital and 1 pair of aggenital setae (*ag*) present (Figs. 2, 18, 20); short (3-5), minutely barbed. Two pairs of anal (*an*) and 3 pairs of adanal (*ad*) setae present (Figs. 2, 20); *an*<sub>1</sub>, *an*<sub>2</sub>, and *ad*<sub>3</sub> similar (6-8 long), minutely barbed; *ad*<sub>1</sub> (12-

15) and *ad*<sub>2</sub> (10-13) similar in shape to dorsal notogastral setae, but shorter. *Lateral surface*: Most of the lateral surface below the lamella, bothridium and antero-lateral edge of the notogaster and above acetabula I-IV with small tubercles (Fig. 3). Tutorium narrow s-shaped ridge, becoming more distant from lamellar edge anteriorly. Carina extending from near middle of tutorium ventrally and anteriorly to below insertion of *ro* (Fig. 3). Pedotectum I (*pd*<sub>1</sub>) covering



Figs. 17–20. *Carabodes dendroetus*, adult. 17, Ventral view of gnathosoma and epimera (590 $\times$ ). 18, Genital plates (1330 $\times$ ). 19, Posterior view of notogaster (445 $\times$ ). 20, Ventral view of genital anal area (770 $\times$ ).

base of acetabulum I, widest ventrally, tapering dorsally to near bothridial base. Exobothridial seta (*ex*) absent (tubercles in area where *ex* should be, make presence of alveolar remnant of *ex* difficult to determine). Pedotectum II (*pd*<sub>2</sub>) a short, blunt tooth partially covering acetabulum II. A short, blunt discidium (*di*) is present between acetabula III and IV. *Legs*: Pits present on the antiaxial surfaces of femora I and II and trochanters and femora III and IV (Figs. 6–9,

12). Porose areas on femora I–IV and trochanters III and IV on paraxial surface. Setation (I to IV, solenidia in brackets), trochanters 1-1-2-1, femora 4-4-3-2, genua 3(1)-3(1)-1(1)-2, tibiae 4(2)-3(1)-2(1)-2(1), tarsi 15(2)-15(2)-15-12. One dissected specimen lacking *fi*" on one tarsus III. Ventrodistal edge of femora III and IV with well developed spur (Figs. 8, 9). Tarsi monodactyl.

Immatures.—Unknown.



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Fig. 21. Known distribution of *Carabodes dendroetus*.



Material examined.—*Holotype*: adult ♂, USA, NEW HAMPSHIRE, Carroll Co., 2.5 mi NW Wonalancet, The Bowl, VII-30-85, D.S.C., sifted rotten beech logs; deposited in Canadian National Collection (Type no. 19463). *Paratypes*: 1 ♀, same data as holotype except VI-21-85, sifted fir/hemlock leaf litter; 1 ♀, 1 mi NW Wonalancet, Spring Brook, VII-10-85, D.S.C., sifted rotten hemlock/fir logs; 1 ♂, same data except IX-5-85; 1 ♂, same data except V-15-85, sifted litter along stream; 1 ♂, Five Fingers Pt., Squam Lake, Sandwich, X-12-64, R.M.R., humus at base of white pine; 1 ♀, Belknap Co., S. Barnstead, VII-2-65, R.M.R., *Quercus rubra* foliage; 1 ♂, Coos Co., Hellgate, Dead Diamond R., VII-13-74, R.M.R., moss on ground in spruce-fir stand; 6 ♂, 8 ♀, 1 sex undetermined, 3 mi NE Errol (Rt. 16), IX-3/4-83, A.G., extracted from spruce branches; 6 ♂, 8 ♀, 6 sex undetermined, same data except extracted from fir branches; 1 ♂, 17 mi N Crystal, IX-9/11-83, A.G., extracted from spruce branches; 2 sex undetermined, same data except extracted from fir branches; 1 ♀, 1 sex undetermined, 6 mi SW Errol (Rt. 16), IX-3/4-83, A.G., extracted from fir branches; 1 ♀, 2 sex undetermined, 5 mi NE Errol (Rt. 16), IX-3/4-83, A.G., extracted from spruce branches; 3 ♀, 1 sex undetermined, 13 mi. NW Errol, Dartmouth Grant, IX-9/11-83, A.G., extracted from fir branches; 1 ♂, 1 sex undetermined, 8 mi NW Errol (Rt. 16), IX-9/11-83, A.G., extracted from fir branches; 1 ♂, 1 ♀, same data except IX-3/4-83; 1 ♂, 10 mi N Milan (Rt. 16) IX-3/4-83, A.G., extracted from spruce branches; 2 ♂, 1 ♀, Grafton Co., Campton, I-6-72, R.H.H., white cedar; 1 sex undetermined, Ellsworth, VIII-1-66, R.H.H., sugar maple bark; 1 ♂, 1 ♀, same data except VI-15-66; 4 ♂, 4 ♀, Plymouth, IV-30-70, R.H.H., sugar maple bark; 1 ♀, Strafford Co., Somersworth, IV-13-77, R.M.R., pine-oak litter; 2 ♂, 2 sex undetermined, Durham, II-17-69, R.M.R., dead bark from top of oak; 24 ♂, 11 ♀, 7 sex undetermined, Durham, IX-14-70, R. M. R., oak bark, cordwood; 6 ♂, 5 ♀,

10 sex undetermined, Durham, V-6-71, R.M.R., white pine bark; 1 ♂, NORTH CAROLINA, Great Smoky Mts. Nat. Pk., 4000', III-27-75, D. R. Blais, litter at base of tree; 1 ♂, Coweeta Hyd. Sta., Shope Fork Rd., 3000', V-30-83, D.S.C., sifted oak and ash litter; 1 ♂, same data except 2450', V-29-83, sifted oak and cherry litter; 1 ♀, PENNSYLVANIA, Somerset Co., 3 mi E Berlin, VII-10-84, D.S.C., sifted rotten wood; 1 ♂, 1 ♀, Warren Co., Hearts Content Nat. Area, Allegheny Nat. For., V-29-85, R.M.R., white pine litter; 1 ♂, Huntington Co., Alan Seeger Nat. Area, V-30-85, R.M.R., bark of chestnut oak; 2 sex undetermined, CANADA, NEW BRUNSWICK, 8 mi W Lake George, VII-18-68, E. E. Lindquist, moss and lichens on white pine trunk; 1 sex undetermined, same data except under bark white pine infested with *Ips pini*; 2 sex undetermined, NOVA SCOTIA, Cape Breton Highlands Nat. Pk., Lone Shieling, VIII-26-83, M. Sharkey, soil, litter and moss. Paratypes are deposited in the United States National Museum, Washington, D.C., Museum of Comparative Zoology, Cambridge, Massachusetts, Canadian National Collection, Biosystematics Research Centre, Ottawa, and author's collection.

This species is found in eastern North America from New Brunswick and Nova Scotia south to North Carolina (Fig. 21).

Remarks.—*Carabodes dendroetus* is most similar to those species of the genus that have *ta*, *ti*, *ms* and *r*<sub>1</sub> in a longitudinal row, all notogastral setae similar in shape and lack a deep cervical cavity. The long rod-like, distally barbed notogastral setae, size and spacing of pitting and the short, barbed capitate sensillus will distinguish *C. dendroetus* from other *Carabodes* species in North America. The leg setal formula of *C. dendroetus* was compared to that of *C. niger* Banks (Norton, 1978), *C. minusculus* Berlese (Bernini, 1976) and *C. willmanni* Bernini (Bernini, 1975) and found to be similar. The positions of (*pv*) on tarsus I and (*pv*) and (*ft*)

on tarsus II in *C. dendroetus* are more similar to *C. niger* than to *C. minusculus*. Also, the size and shape of (v) on tibia I does not vary in *C. dendroetus* and *C. niger* as much as in *C. minusculus*. The ventrodiscal spur of femur III and IV is more developed in *C. dendroetus* than in either *C. niger* or *C. minusculus*.

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